

Los Alamos National Laboratory  
Environmental Restoration Program  
Standard Operating Procedure

No: LANL-ER-SOP-03.04 Rev: 0

Petrography

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## **PETROGRAPHY**

### **1.0 PURPOSE**

The purposes of this procedure are (1) to standardize the petrographic descriptions used within mineralogy-petrology tasks through use of a set of primary reference books and (2) to assure adequate documentation of petrographic descriptions.

### **2.0 SCOPE**

This procedure may be used for any petrographic descriptions made by standard optical methods (i.e., unaided visual observation, hand lens, binocular microscope, petrographic microscope) for the Environmental Restoration Program.

#### **2.1 Applicability**

This procedure is applicable to all researchers working on the Environmental Restoration Program who are responsible for describing rock units occurring within lands covered by the Environmental Restoration Program.

#### **2.2 Training**

Completion of at least one college-level course in petrography and a minimum of a BS in Geology or Earth Sciences are required to use this procedure. Researchers using this procedure must also document that they have read and understood this procedure and the six procedures in Section 1.0, General Instructions.

### **3.0 DEFINITIONS**

There are no unique definitions in this procedure.

### **4.0 BACKGROUND AND/OR CAUTIONS**

The principles of petrographic analysis are learned through college-level course work. The standard reference for this procedure is Williams et al. (1954). Mineral identification and description can be augmented by use of other texts such as Wahlstrom (1955) and Tomkeieff (1983).

The only significant source of uncertainty and error in petrographic description is mineral and textual misidentification. Analysts are advised to refrain from making optical mineral identifications where the minerals are too fine-grained for adequate analysis or where the topical properties are ambiguous. Where mineral identifications must be ventured without certain optical identity, the entry should be marked as "possible," "?," or otherwise queried.

Uncertainties and errors in quantitative petrographic analyses are described in the procedure, Determination of Volume Constituents in Thin Sections of Rock, SOP-03.05.

## 5.0 EQUIPMENT

Petrographic descriptions may be obtained by unaided visual observations, by hand lens, by binocular microscope, or by petrographic microscope. Any brand or model of lens or optical microscope may be used for petrographic analysis.

## 6.0 PROCEDURE

Petrographic descriptions are either descriptive or quantitative. No two analysts will generate identical descriptions. For such descriptions, the recorded information will be traceable to a specific location in the field or to a specific sample in the laboratory to allow other petrographers to review the description. Photographs and drawings, appropriately keyed to specific field locations or samples, may be used to support petrographic descriptions. Quantitative petrographic analysis includes, but is not limited to, point counting and size measurement. Point counting is described in procedure SOP-03.05. Coarse features may be measured by any standard scale, with metric units preferred; microscopic features may be measured by ocular scale. These scales are used for approximate and relative size classification only; thus calibration of the scales is not required. Examples of petrographic descriptions appropriate to this procedure can be found in the figure captions of Williams et al. (1954). The standard reference for petrographic terms will be Bates and Jackson (1980), Tomkeieff (1983), and Wahlstrom (1955). Many of the terms used for textural features of silicic volcanic rocks are described in Ross and Smith (1961) and Smith (1960).

Petrographic analyses are considered acceptable as descriptive data. Rejections of certain parts of a petrographic analysis may be made by the same analyst or by another analyst based on reanalysis of the same sample; in such a case, the cause for the rejection should be described in the reanalysis and referred back to the original analysis. Because a wide latitude is possible in descriptive parameters, such rejections should be rare. The likeliest cause of a rejection is mineral misidentification based on optical properties; where mineral identity is optically ambiguous and important to the sample description, confirmation of mineral identity should be sought through Operating the Microprobe, SOP-09.02; Operation of Siemens X-Ray Diffractometer, SOP-09.03; or Operation of Scanning Electron Microprobe, SOP-09.07.

Petrographic descriptions are recorded in ink on the attached Petrographic Description Form. Photographs may be attached as part of the description, and sketches may be used. It is advisable to mark or describe the scale of any photograph or sketch.

## 7.0 REFERENCES

LANL-ER-SOP-Section 1.0, Procedures, General Instructions  
LANL-ER-SOP-03.05, Determination of Volume Constituents in Thin Section of Rocks.  
LANL-ER-SOP-09.02, Operating the Microprobe.

LANL-ER-SOP-09.03, Operation of Siemens X-Ray Diffractometer.

LANL-ER-SOP-09.07, Operating Instructions for the International Scientific Instruments Model DS-130 Scanning Electron Microscope and Tracor Northern Series 11 X-ray Analyzer.

Bates, R. L. and J. A. Jackson (editors). 1980. Glossary of Geology. American Geological Institute, Washington, D. C.

Ross, C. S., and R. L. Smith. 1961. Ash-flow tuffs: Their origin, geologic relations and identification. U.S. Geol. Survey Prof.

Smith, R. L. 1960. Zones and zonal variations in welded ash flows. U.S. Geol. Survey Prof. Paper 354-F, p. 149-159.

Tomkeieff, S. I. 1983. Dictionary of Petrology. Wiley, 680p.

Wahlstrom, E. E. 1955. Petrographic Mineralogy. Wiley, 407p.

Williams, H., F. J. Turner, and C. M. Gilbert. 1954. Petrography. W. H. Freeman and Co., San Francisco.

## 8.0 RECORDS

Petrographic descriptions are recorded on Petrographic Description Form. Maps or photographs should be marked with sample or locality numbers that can be uniquely related to a notebook entry (sample numbering requirements are described in SOP-01.04, Sample Control and Field Documentation).

## 9.0 ATTACHMENTS

Petrographic Description Form

## PETROGRAPHIC DESCRIPTION FORM

<b>LOS ALAMOS NATIONAL LABORATORY</b> <b>ENVIRONMENTAL RESTORATION</b> <b>PETROGRAPHIC DESCRIPTION FORM</b>		Sheet _____ of _____
Date: _____	Technical Area _____ Operable Unit _____	<div style="display: flex; justify-content: space-around;"> <div style="border: 1px dashed black; padding: 5px; width: 45%;">             AFFIX FIRST SAMPLE STICKER HERE           </div> <div style="border: 1px dashed black; padding: 5px; width: 45%;">             AFFIX LAST SAMPLE STICKER HERE           </div> </div>
Site Work Plan: _____		
Signature: _____		
<div style="border: 1px solid black; padding: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <b>1. Hand Sample Description</b>             1a. Estimated Volume: _____         </div> <div style="width: 45%;">           1b. Estimated Size: _____         </div> </div> </div>		
<div style="border: 1px solid black; padding: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <b>2. Microscope Study for Classification</b>             2a. Primary Features: _____             3a. Secondary Features: _____         </div> <div style="width: 45%;">           2c. Mineralogy:   <div style="margin-left: 20px;">Essential Minerals (Vol. %):</div>   <div style="margin-left: 20px;">Accessory Minerals:</div>   <div style="margin-left: 20px;">Secondary Alteration:</div> </div> </div> <div style="margin-top: 10px;">           2d. Special Features: _____         </div> </div>		
<b>3. Stratigraphic Assignment (if known):</b>  _____		
<b>4. Rock Classification:</b>  _____		
<b>5. Comments (be sure to record Geologic Setting/Occurrence):</b>  _____		